

Requested Patent: GB534522A

Title:

IMPROVEMENTS IN RETRACTABLE LANDING GEAR FOR
AIRCRAFT ;

Abstracted Patent: GB534522 ;

Publication Date: 1941-03-10 ;

Inventor(s): ;

Applicant(s): ALEXANDER CRABB REID ;

Application Number: GB19390017173 19390612 ;

Priority Number(s): GB19390017173 19390612 ;

IPC Classification: ;

Equivalents: ;

ABSTRACT:

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PATENT SPECIFICATION



Application Date: June 12, 1939. No. 17173/39.

534,522

Complete Specification Left: April 29, 1940.

Complete Specification Accepted: March 10, 1941.

PROVISIONAL SPECIFICATION

Improvements in Retractable Landing Gear for Aircraft

I, ALEXANDER CRABB REID, a British Subject, of "Bagnets", Naphill, High Wycombe, Buckinghamshire, do hereby declare the nature of this invention to be
5 as follows:—

This invention relates to retractable landing gear for aircraft, and the primary object of the invention is to provide an improved arrangement of the gear and its housing when in the
10 retracted position.

According to the invention an aircraft is provided with a retractable undercarriage which is mounted for lowering and retracting movement transversely of the aircraft and which is mainly enclosed in fairing movable therewith constituting an aerofoil in the retracted position of the undercarriage.
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According to a further feature of the invention, the aerofoil aforesaid constitutes a substantial portion of the tip of a supporting wing, for example, a comparatively short span or stub wing.
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In a preferred construction a retractable undercarriage as aforesaid is pivotally mounted on a fixed part of the wing and operated by means of a hydraulic motor housed within this fixed part of the wing. The undercarriage conveniently comprises a supporting leg which is pivoted at the end of the fixed part of the wing and has an outwardly extending crank arm connected by an actuating link to an engine driven member moving lengthwise of the wing. For bracing the leg transversely of the craft there is preferably provided a strut pivoted at one end on the leg and slidable at the other
30 end in a guide in the fixed part of the wing. This strut is arranged to move into the wing in the retracted position of the undercarriage.

One specific application of the invention is to a high-winged monoplane having power units mounted in or on the wing at opposite sides of the fuselage. Below the wing there is arranged a stabilising stub wing of comparatively short span, a substantial portion of the wing tip at each end being pivoted for downward movement through approximately the right angle.
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The fixed part of the stub wing may be built up on framing of any suitable construction and arrangement, preferably such that the main former incorporates the top front wing spar and the bottom rear stub wing spar. These spars are interconnected at each end of the fixed part of the stub wing by a streamlined tubular strut, which struts serve to support the power units during landing.
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At each end of the fixed part of the stub wing and at its lower surface there is pivoted a landing leg carrying a landing wheel at its outer end, this landing leg being movable from a position extending downwardly in the landing position of the gear to a position extending substantially horizontally and outwardly from the fixed part of the stub wing in the retracted position. The pivotal mounting of the legs is directly below the base of the struts extending to the main wing. These landing legs preferably incorporate hydraulic shock-absorbing means of known form.
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Each of the landing legs is provided with a crank arm extending from the leg in the lower position outwardly and upwardly from the pivotal connection of the leg on the stub wing. To the outer end of its crank arm one end of an adjustable actuating link is pivotally connected, the other end of this link being pivoted to a movable member of a hydraulically operated piston and cylinder device mounted in the fixed part of the stub wing for actuating the retractable undercarriage. This movable member is arranged for moving lengthwise of the stub wing.
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For each of the landing legs there is an adjustable stay pivoted on the leg at one end and pivoted at the other end on a slide movable in a guide along the bottom of the stub wing, the slide being provided with roller bearings engaging with the slide. In the lowered position of the carriage, this slide is arranged to abut against a buffer formed by a bracing member inserted in the frame of the fixed part of the stub wing between the stub wing spars. The upper surface of the slide is provided with an inclined
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[Price 1/-]

surface to engage the nose of a retaining catch during the movement consequent on lowering of the undercarriage. This catch is pivoted for vertical movement on 5 the fixed part of the stub wing and is arranged to engage behind an abutment on the slide in the fully lowered position of the undercarriage. A spring is provided to urge the catch into engagement 10 with the block and to retain the catch in the position locking the undercarriage in the lowered position. Means is provided for limiting the movement of the catch when not engaging with the slide 15 such as a pin extending through the catch and arranged to bear upon the guide for the slide. An operating cable may be secured to the free end of the catch for moving it to disengage the slide when 20 the undercarriage is to be retracted. An indicator may also be operated by this end of the catch to show the pilot the position of the catch.

A section of outer skin for the fixed 25 part of the stub wing is secured to the slide such that when the landing gear is retracted, the slot for the stay is closed with the stay located within the wing structure. A similar section of the wing 30 skin is carried by the stay itself to close the remainder of the slot in the fixed part of the stub wing.

Each leg of the undercarriage and part 35 of the wheel are enclosed within fairing constructed to provide surfaces which in the retracted position of the landing gear are properly in line with the sur-

faces of the fixed part of the stub wing, the lower parts of the wheels, however, necessarily extending laterally beyond 40 the end of this movable section of the wing. The effective span of the stub wing is thus the length of the fixed part plus the additional surface as aforesaid at each end, when the landing gear is 45 retracted.

In order to retain the undercarriage in the retracted position, locking means is provided such as an eye or eyes on the movable part of the stub wing arranged 50 to be engaged by a hydraulically operated locking pin on the fixed part of the stub wing in the retracted position of the undercarriage. Alternatively, a spring-operated catch such as is employed for the 55 slide may be used and operated by means of a cable. The landing legs may each be braced by means of a stay connected at one end to the leg and at the other end forwardly to the lower end of the 60 front spar of the stub wing, the connections of this stay being such as to permit the required movement of the landing leg.

It will be understood that the invention is not restricted to the specific embodiment hereinbefore described which may be modified according to various requirements.

Dated this 12th day of June, 1939.
BOULT, WADE & TENNANT,
Chartered Patent Agents,
111 & 112, Hatton Garden,
London, E.C.1.

COMPLETE SPECIFICATION

Improvements in Retractable Landing Gear for Aircraft

70 I, ALEXANDER CRABB REID, a British Subject, of "Bagnets", Naphill, High Wycombe, Bucks, do hereby declare the nature of this invention and in what manner the same is to be performed, to 75 be particularly described and ascertained in and by the following statement:—

This invention relates to retractable landing gear for aircraft, and the primary object of the invention is to provide 80 an improved arrangement of the gear and its housing when in a retracted position.

According to the invention there is provided an aircraft in which a retractable 85 undercarriage is incorporated in the tip part of a supporting wing with the wheel at the end of the wing and in which this tip part is hinged at its inner end to a fixed part of the supporting wing about 90 an axis lengthwise of the aircraft for lowering and retracting movement of the undercarriage.

In a preferred construction the tip part of the supporting wing is hinged to the fixed part of the wing on the under- 95 side thereof. The undercarriage is conveniently actuated by an engine housed in the fixed part of the supporting wing.

It is also preferable to provide a bracing strut for the undercarriage in the 100 lower position, which bracing strut is connected at one end to the undercarriage and at the other end to a slide guided lengthwise in the fixed part of the supporting wing. Means is preferably provided to lock the slide in the position corresponding to the lowered position of the undercarriage so as to brace and lock the undercarriage in the lowered position. 105

One specific application of the invention to high winged monoplanes and amphibians is shown by way of example in the accompanying drawings, in which:

Figure 1 is a sectional elevation of the landing gear in the retracted flying position;

Figure 2 is a sectional plan of the 5 landing gear shown in Figure 1;

Figure 3 is a sectional front elevation of the landing gear in the landing position;

Figure 4 is a sectional side elevation 10 of the landing gear in the landing position;

Figure 5 is an isometric view of the landing gear and stub wing in the landing position;

15 Figure 6 is a front elevation of the landing gear and stub wing in the flying position, and

Figures 7, 8 and 9 are detail views 20 showing the locking means for a bracing strut of the landing gear.

Referring to the drawings there is provided at each side of the fuselage m of the aircraft and below the main supporting wing a stabilising stub wing of comparatively short span consisting of a fixed inner part y and an outer part h hinged at $a1$ on the under-side of the stub wing to the fixed part for downward movement through approximately a 30 right-angle.

Mounted within the movable part h of the stub wing and fixed to the frame structure $h1$ thereof there is a landing leg j carrying a landing wheel $j1$ at its 35 outer end, this landing leg comprising hydraulic shock-absorbing means of known form. This landing leg has two arms a by means of which it is rotatably mounted about the hinge axis $a1$ in bearings carried by stiffening plates o fixed to the frame $y1$ of the fixed part of the stub wing. The landing leg also has a crank b coupled by a connecting rod c to the movable member $c1$ of a hydraulic 40 ally-operated piston and cylinder device mounted on the frame $y1$ of the fixed part of the stub wing. The member $c1$ moves in a direction lengthwise of the stub wing for rotating the landing leg and the 45 movable part of the stub wing about the hinge axis $a1$. The landing leg, together with the movable part of the stub wing, may thus be moved by the engine either to the position shown in Figure 5, in which the undercarriage is in the lowered 50 position, or to the retracted position shown in Figure 6, in which the movable part of the stub wing is properly positioned with respect to the fixed part of the stub wing to constitute a single supporting surface.

A movable bracing strut k for the landing leg is pivoted at one end at l on a bracket $j2$ on the landing leg and at the 60 other end at $l1$ to a slide w

movable lengthwise of the fixed part y of the stub wing. The slide w carries bearing trunnions x at each side running in opposed channel guides v secured to the frame $y1$. In the lowered 70 position of the undercarriage the slide w is arranged to abut against a buffer constituted by a member $v1$ (Fig. 1) of the frame of the fixed part of the stub wing.

Locking means for holding the undercarriage in the lowered position comprises a retaining catch e pivotally mounted on fixed brackets f for vertical movement and pressed downwardly by a compression spring r bearing at one end on the catch and at the other end on a fixed abutment u . The slide w is provided with an inclined surface $w1$ which when the undercarriage is being lowered engages the nose of the retaining catch and raises the catch against the action of the spring. When the undercarriage is in the fully lowered position the slide w abuts against the member $v1$ of the frame and the catch is moved downwardly by its spring to engage behind the slide w to hold it in position against the frame member $v1$. The landing gear is therefore locked in the lowered position. An operating cable s is secured to the catch for lifting it against the action of the spring to disengage the slide w when the undercarriage is to be retracted. A linkage t connected to the outer end of the catch serves to operate an indicator 100 (not shown) to show the pilot the position of the catch.

In order to retain the undercarriage in the retracted position locking means is employed similar to that for holding the 105 undercarriage in the lowered position. A retaining catch $e1$ (Figs. 1 and 3) is pivotally mounted for vertical movement on brackets $f1$ on the frame $y1$ of the fixed part of the stub wing and is pressed 110 downwardly by means of a spring $r1$ bearing at one end on the catch and at the other end on a fixed abutment on the frame $y1$. The downward movement of the catch $e1$ is limited by a cross-pin $p1$ 115 (Fig. 2) carried at its ends on brackets $q1$ secured to the frame $y1$. A latch member $d1$ secured to the frame $h1$ of the movable part of the stub wing is arranged to ride on a guide g (Figs. 1 and 3) on 120 the fixed part of the stub wing when the undercarriage is raised. This latch member engages with the nose of the catch $e1$ and raises the catch against the action of its spring.

In the fully retracted position of the undercarriage the catch engages behind the latch to hold the movable part of the stub wing in the flying position. The landing leg is also supported by means 125 130

of a stay *n* connected at one end to the bracket *j2* and at the other end to a fixed frame part of the stub wing well to the rear of the landing leg, the connections of this stay being pivoted to permit the required movement of the landing leg. A second hinge connection between the fixed and movable parts of the stub wing may be provided to the rear of the hinge connection provided by the landing leg and the stay may be connected at its rear end to this hinge.

The fixed part of the stub wing has an outer skin *y2* formed with a slot through which the bracing strut *k* passes in the lowered position of the undercarriage and a movable skin section *y3* (Figs. 7 and 8) is secured to the slide *w* so as to close this slot when the undercarriage is retracted. The movable part of the stub wing has an outer skin *h2* which is also slotted for the passage of the bracing strut *k* in the lowered position of the landing gear and a movable skin section *h3* is secured to the strut by small brackets *c2* (Figs. 7 to 9) so as to close this slot in the retracted position of the undercarriage. A small section of wing skin indicated at *a2* (Figs. 7 and 8) is provided between the adjacent ends of the skin sections *h3* and *y3*. This skin section *a2* is hinged at one end to the skin section *h3* and is held up in position by a small leaf spring *a3*. The other end of this skin section *a2* is chamfered so as to ride over the outside of the adjacent end of the skin section *y3* when the undercarriage is lowered.

With the construction of undercarriage herein described with reference to the drawings, the undercarriage is enclosed within the movable part of the stub wing except for the lower part of the wheel which extends somewhat beyond the stub wing. The effective span of the stub wing is thus the length of the fixed part thereof plus the additional surface of the

movable part properly in line with the fixed part with the undercarriage in the retracted position. The movable part of the stub wing is moved as a whole downwardly through approximately 90° to lower the undercarriage.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. An aircraft in which a retractable undercarriage is incorporated in the tip part of a supporting wing with the wheel at the end of the wing and in which this tip part is hinged at its inner end to a fixed part of the supporting wing about an axis lengthwise of the aircraft for lowering and retracting movement of the undercarriage.

2. An aircraft as claimed in claim 1, wherein the tip part of the supporting wing is hinged to the fixed part of the wing on the under-side thereof.

3. An aircraft as claimed in claim 2, wherein the undercarriage is actuated by an engine housed in the fixed part of the supporting wing.

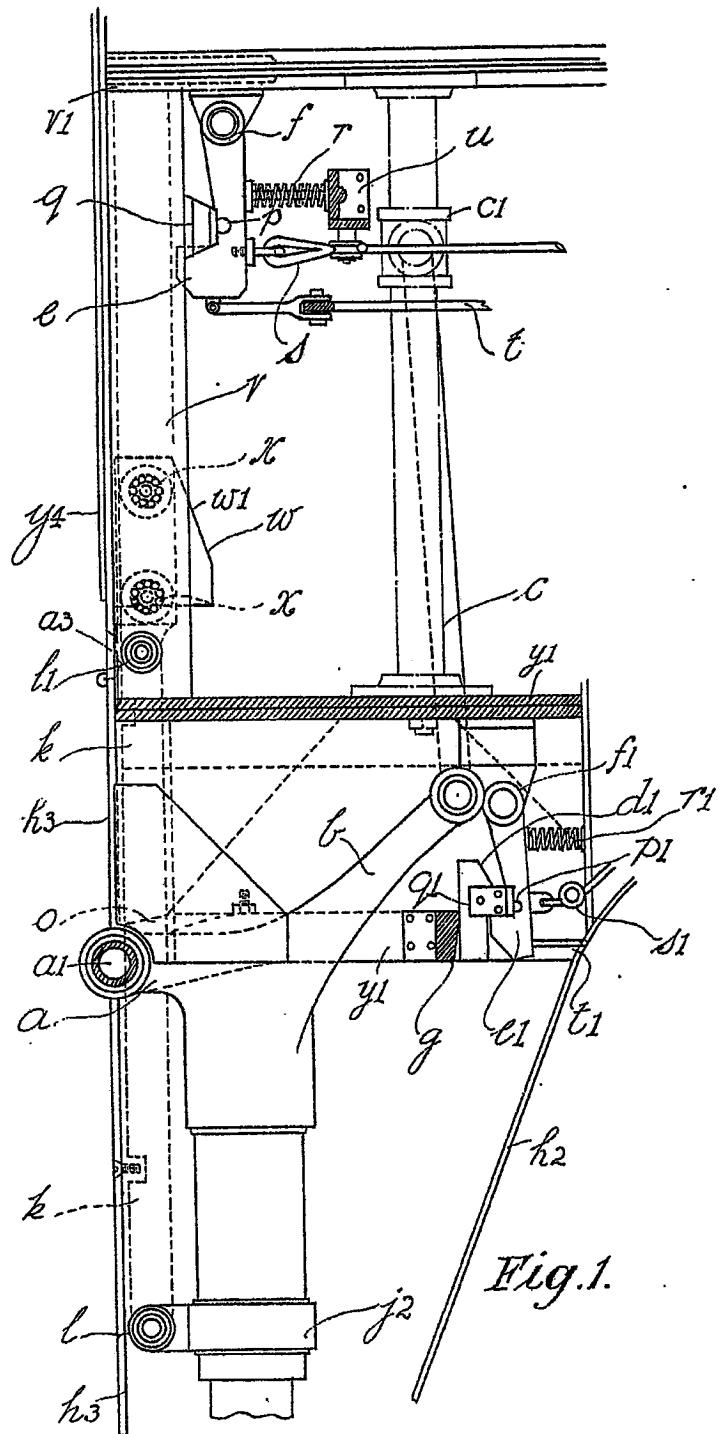
4. An aircraft as claimed in claim 2 or 3, comprising a bracing strut for the undercarriage in the lowered position, which bracing strut is connected at one end to the undercarriage and at the other end to a slide guided lengthwise in the fixed part of the supporting wing.

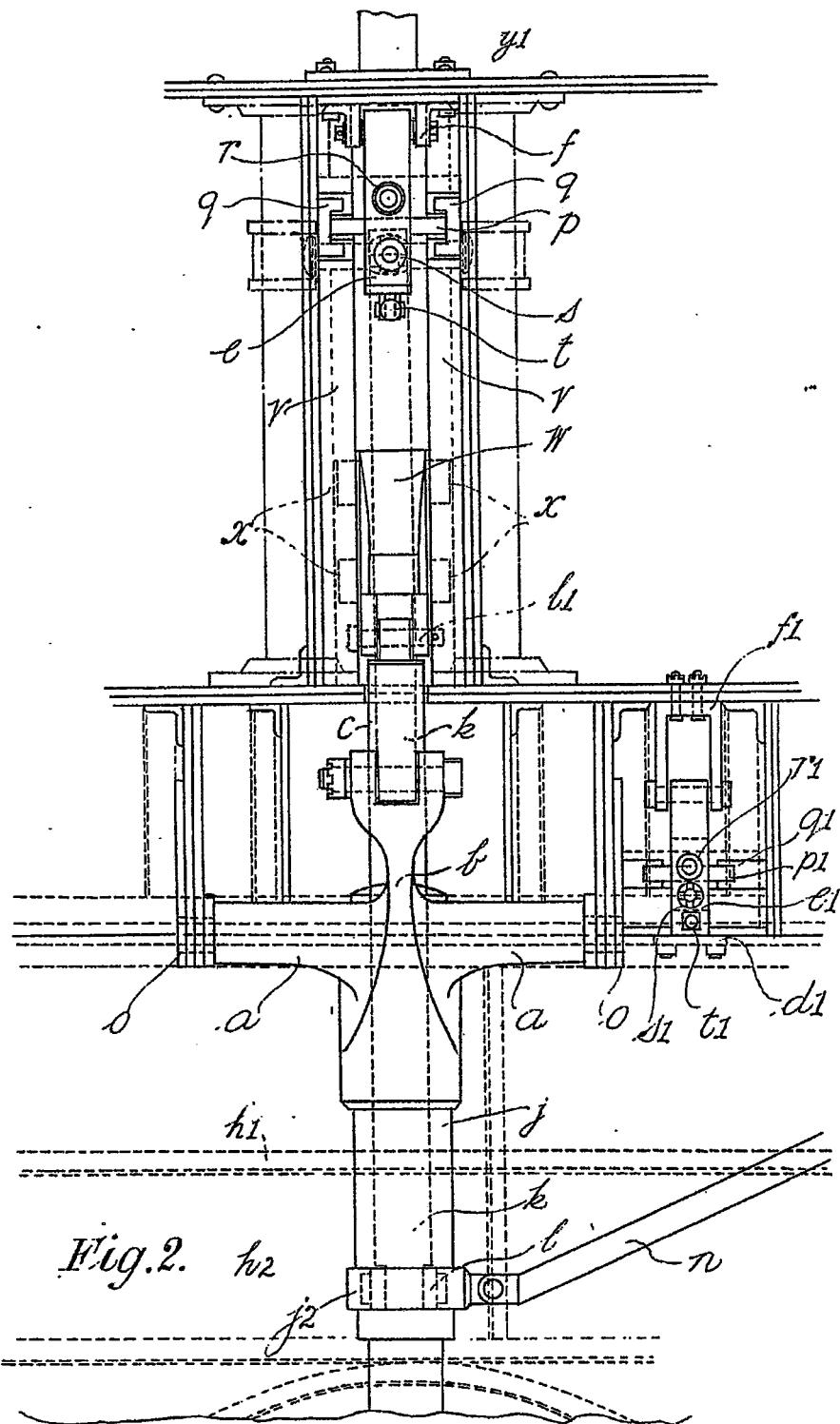
5. An aircraft as claimed in claim 4, comprising releasable means to lock the slide in the position corresponding to the lowered position of the undercarriage.

6. A high-winged monoplane or amphibian having landing gear substantially as herein described with reference to the accompanying drawings.

Dated this 29th day of April, 1940.
BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.1,
Chartered Patent Agents.

[This Drawing is a reproduction of the Original on a reduced scale.]





533,522 COMPLETE SPECIFICATION

SHEET 1

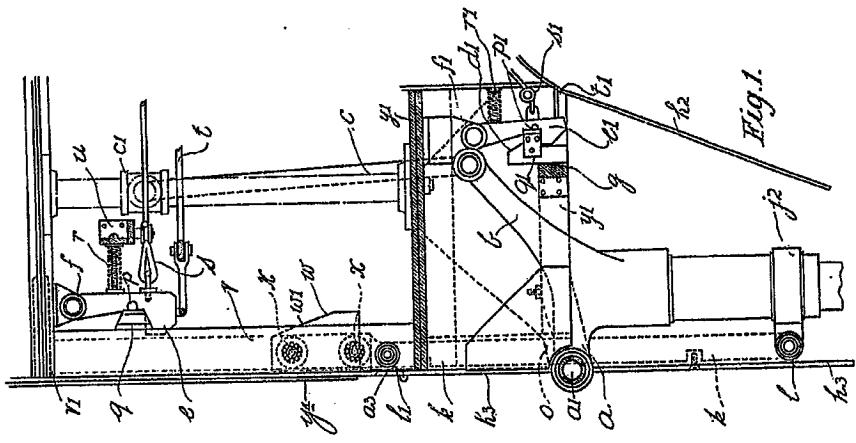


Fig. 1.

5 SHEETS
SHEET 2

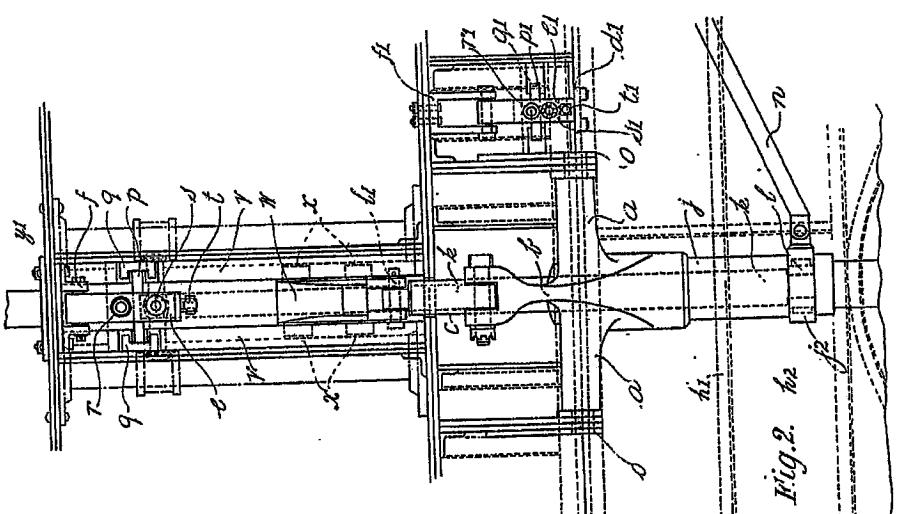


Fig. 2.

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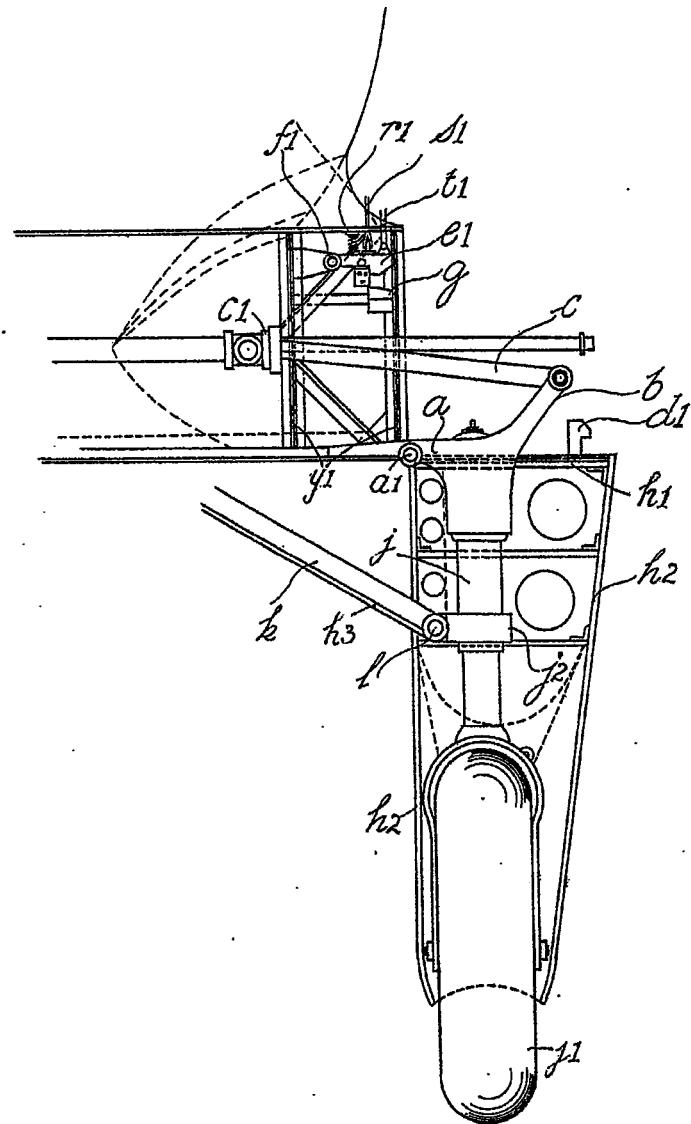


Fig.3.

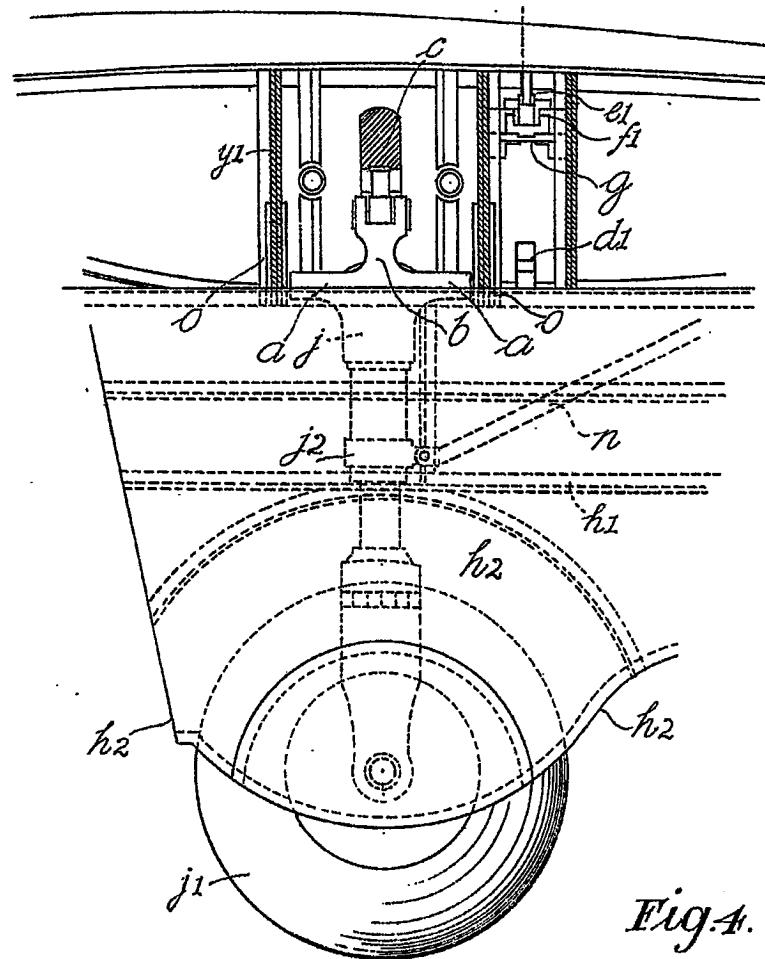


Fig.4.

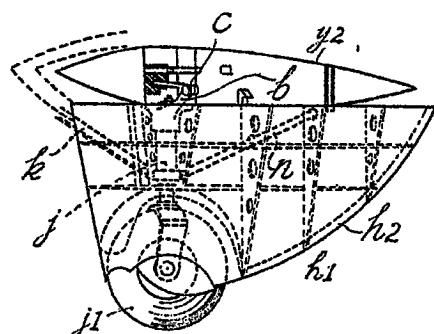


Fig.5.

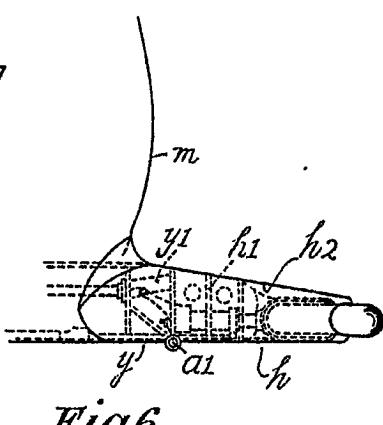


Fig.6.

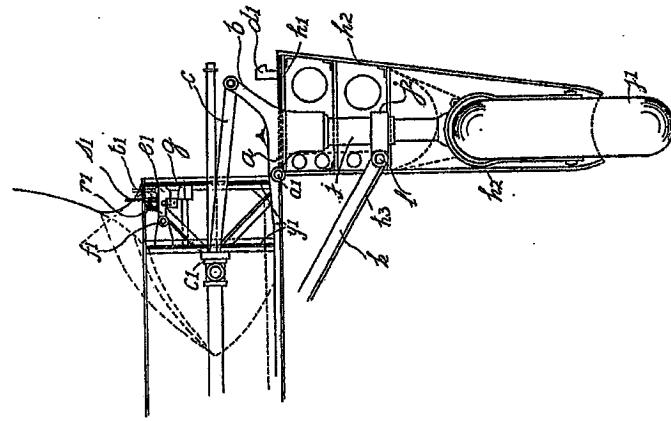


Fig.3.

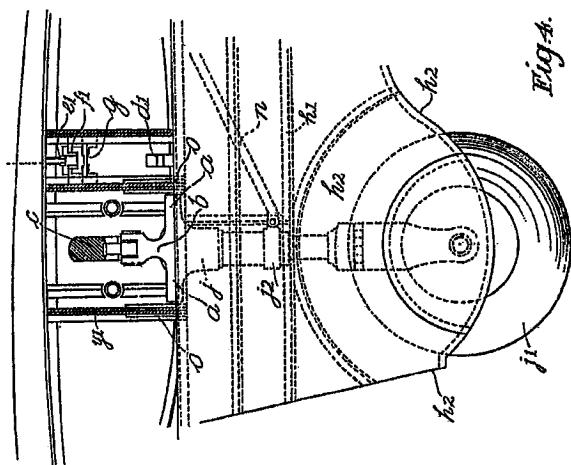


Fig.4.

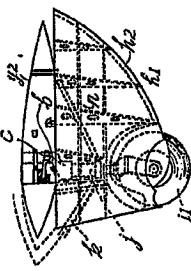


Fig.5.

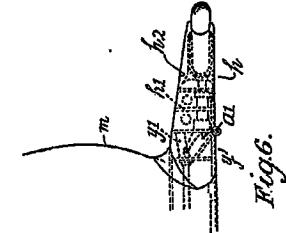


Fig.6.

[This Drawing is a reproduction of the Original on a reduced scale.]

